

PERFORMANCE SPECIFICATION SHEET
ELECTRON TUBE, RADIATION COUNTER
TYPE 7301

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

DESCRIPTION: Low sensitivity, self-quenching for detection of gamma radiation.

See figure 1.

Mounting position: Any.

Weight: 0.45 ounce (12.76 grams).

ABSOLUTE RATINGS:

Parameter:	Ebb	Rp	TA
Unit:	V dc	Meg Ω	°C
Maximum:	725	---	+75
Minimum:	675	---	-40
Test conditions:	700	1.0	---

GENERAL:

Qualification - Required.

Marking - See 1/ 16/. Tubes sold under service-life guarantee shall be marked with contract number and with the number of operating hours (500 hours minimum) guaranteed.

Service-life guarantee (MIL-PRF-1) - With qualifying activity approval manufacturer may provide service-life guarantee, in lieu of life test. Guaranteed tube operating time shall be 500 hours minimum (see 16/).

Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: DSCC-VAT, P.O. Box 3990, Columbus, OH 43216-5000 or e-mailed to TubesFiberOptic@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at www.dodssp.daps.mil.

TABLE I. Testing and inspection.

Method MIL-STD- 1311	Requirement or test	Notes	Conditions	Acceptance level <u>14/</u>	Symbol	Limits		Unit
						Min	Max	
	<u>Conformance inspection, part 1</u>							
6201	Background, contamination, and photosensitivity	<u>2/ 3/ 4/</u>	t = 2 minutes	0.65	N/t	---	10	Npm
6211	Starting voltage	<u>4/</u>	Pulse amplitude = 1 V; Nps = 200 (max); R2 = 1 Meg Ω \pm 10%; R1 = C1 = C2 = 0; C3 = 0.01 μ F \pm 10%	0.65	Es	---	640	V dc
6216	Relative plateau slope	<u>5/</u>	Voltage range = 660 to 760 V dc	0.65	Ps	---	0.2	%/V dc
6216	End-of-plateau voltage	<u>5/</u>	Ps = 0.3/V dc	0.65	Ee	780	---	V dc
6221	Response count rate and current (gamma)	<u>5/ 6/ 7/</u>	t = 2 minutes	0.65	N/t	75	125	Nps
	<u>Conformance inspection, part 2</u>							
6221	Response current	---	Gamma (radium) rate = 500 mr/hr; Ebb = 710 V dc	---	lb	---	10.0	μ A dc
6226	Pulse amplitude (1)	<u>4/</u>	Ebb = 675 V dc; Nps = 200 (max); R1 = 0.9 Meg Ω \pm 10%; R2 = 0.1 Meg Ω \pm 10%; C1 = 330 pF \pm 10%; C2 = 3,000 pF \pm 10%; C3 = 0.01 μ F \pm 10%; multiply oscillo- scope reading by 10	---	eo	2.5	---	v
6226	Pulse amplitude (2)	<u>4/</u>	Pulse amplitude (1), except Ebb = 725 V dc	---	eo	---	65	v
	<u>Conformance inspection, part 3</u>							
---	Life test	<u>16/</u>	Group A; counting rate = 1,000 Nps (min); t = 500 hours	---	---	---	---	---
---	Life-test end points	<u>10/ 16/</u>		---	---	---	---	---
1031	Variable-frequency vibration	<u>8/ 11/ 13/ 15/</u>		---	---	---	---	---
---	Temperature cycling	<u>12/ 13/</u>		---	---	---	---	---
1041	Shock	<u>8/ 9/ 13/ 15/</u>	600 G	---	---	---	---	---
6205	Leakage current	<u>13/</u>	Ebb = 500 V dc	---	Llb	---	0.5	μ A dc

See footnotes at top of next page.

TABLE I. Testing and inspection - Continued.

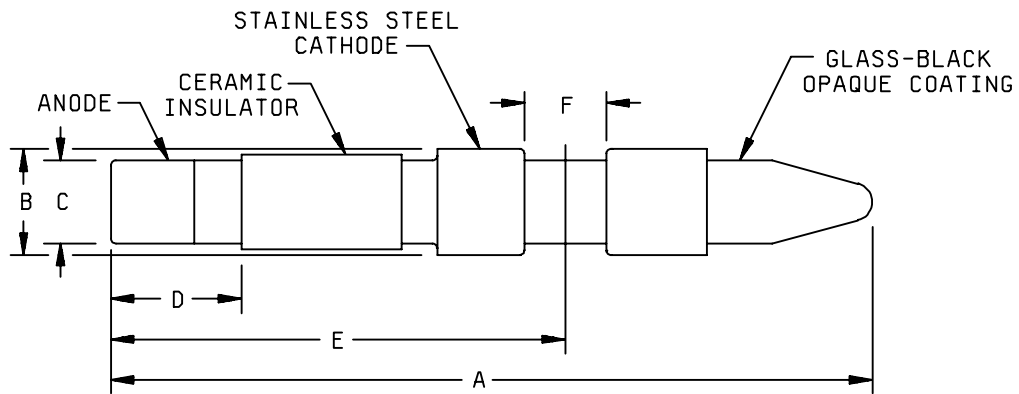
- 1/ Each tube shall have an individual serial number permanently marked on the cathode.
- 2/ In determining tube response (count rate) $E_{bb} = 700$ V dc and $R_p = 1 \text{ Meg}\Omega \pm 10\%$. Tube count rates shall be determined using a scaler having a resolving time of 5 μ s and a discrimination level of 0.25 volts.
- 3/ The tube shall be exposed to radiation from a General Electric 15-watt germicidal lamp and a General Electric 15-watt fluorescent lamp, or equivalents, with relative positions as shown on figure 2.
- 4/ Test shall be performed at the conclusion of the holding period.
- 5/ Method B (MIL-STD-1311, test method 6216); the scaler of 2/ may be utilized for this test.
- 6/ The response characteristics, current, and count rate versus field intensity of a type 7301 radiation counter tube shall be as shown on figure 3. In determining tube response, $E_{bb} = 700$ V dc and $R_p = 1 \text{ Meg}\Omega \pm 10\%$. Tube current shown as measured by means of a microammeter in series with the tube cathode, and the count rates as determined using a scaler having a resolving time of 5 μ s and a discrimination level of 0.25 volts.
- 7/ Use Government approved standard gamma test unit.
- 8/ Criterion for passing this test shall be compliance after test of at least 80 percent of the tubes with the requirements for:
 - a. Starting voltage.
 - b. Gamma response (count rate).
 - c. Pulse amplitude (1) and (2).
 - d. End-of-plateau voltage.
 - e. Relative plateau slope.
- 9/ The tube shall be rigidly mounted in positions X, Y, and Z, by means of a clamp at the center of the cathode. The tube shall be given 10 blows at the X position and 5 at each of the other test positions.
- 10/ The limits for acceptability shall be as follows:

Background, contamination, and photosensitivity:	12 Npm, maximum.
Starting voltage:	Initial value ± 10 volts.
Plateau length:	125 volts, minimum.
Relative plateau slope:	0.25 percent/V dc, maximum.
End-of-plateau voltage:	750 volts, minimum.
Gamma response (count rate):	Initial value ± 10 percent.
Pulse amplitude (1) and (2):	Initial limits.
- 11/ The tube shall be mounted with its longitudinal axis horizontal and perpendicular to the direction of motion by means of a rigid clamp at the center of the cathode. The time for gradually covering the frequency range shall be 15 minutes.
- 12/ With the tube in a field giving 100 ± 10 Nps at 700 V dc, the tube response (count rate) at 675, 700, and 725 V dc shall be determined at each of the following temperatures and in the order shown:
 1. Room temperature.
 2. -40°C .
 3. Room temperature.
 4. $+75^\circ\text{C}$.
 5. Room temperature.

A minimum stabilization of 30 minutes shall be allowed at each temperature. The absolute count rate at 700 V dc, and the average relative plateau slope as determined by the readings at the 3 voltages (best average position of straight line), shall not differ from the initial readings at room temperature by more than 10 percent and ± 0.1 percent/volt, respectively, at any of the four subsequent temperatures shown.

TABLE I. Testing and inspection - Continued.

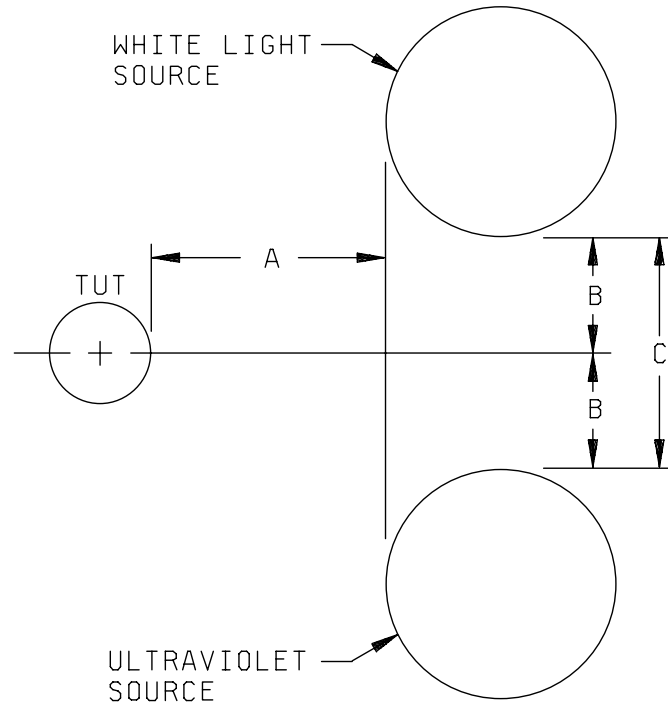
- 13/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. A zero defect sampling plan shall be used, with a sample of three tubes with an acceptance number of zero. In the event of failure, the test will be made as a part of conformance inspection, part 2, with an acceptance level of 0.65 (see MIL-PRF-1, table III). The regular "12-calendar month" zero defect sampling plan shall be reinstated after three consecutive samples have been accepted.
- 14/ This specification sheet uses accept on zero defect sampling plan in accordance with MIL-PRF-1, table III.
- 15/ The manufacturer, with the approval of the qualifying activity, may perform this test on a periodic basis, versus performing the test on every lot. Approval will be based on demonstrating to the qualifying activity the capability of the design to meet this requirement. If the design, material construction or processing of the tube is changed or if there are any quality problems, the qualifying activity may require resumption of the original testing frequency. This allowance does not relieve the manufacturer from meeting the test requirements in case of dispute.
- 16/ With qualifying activity approval the manufacturer may provide, in accordance with MIL-PRF-1, service-life guarantee, in lieu of performing life testing. Life test endpoints specified shall apply to service-life guarantee conformance as well as to life test conformance. The number of hours of system-deployed, accumulated tube-operating time shall be approved by the qualifying activity and shall be a minimum of 500 hours. Service-life guarantee shall define tube operating life and not time from purchase or delivery. Tubes sold under service-life guarantee shall be marked with contract number and with the number of tube operating hours guaranteed.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
	Conformance inspection, part 2			
A	---	2.375	---	60.32
B	.334	.354	8.48	8.99
C	.245	.255	6.22	6.48
D	.250	---	6.35	---
E	1.344	1.468	34.14	37.29
F	.250	---	6.35	---

NOTE: Provision must be made to hold the anode wire concentric to the cathode at each end of the cathode. Anode wire is continuously maintained in tension.

FIGURE 1. Outline drawing of electron tube type 7301.



Ltr	Dimensions			
	Inches		Millimeter	
	Min	Max	Min	Max
A	---	1.000	---	25.40 mm
B	---	.500	---	12.70 mm
C	---	1.000	---	25.40 mm

NOTE: Center of sensitive volume of tube and centers of lamps lie in plane of paper.

FIGURE 2. Position of tube for photosensitivity test.

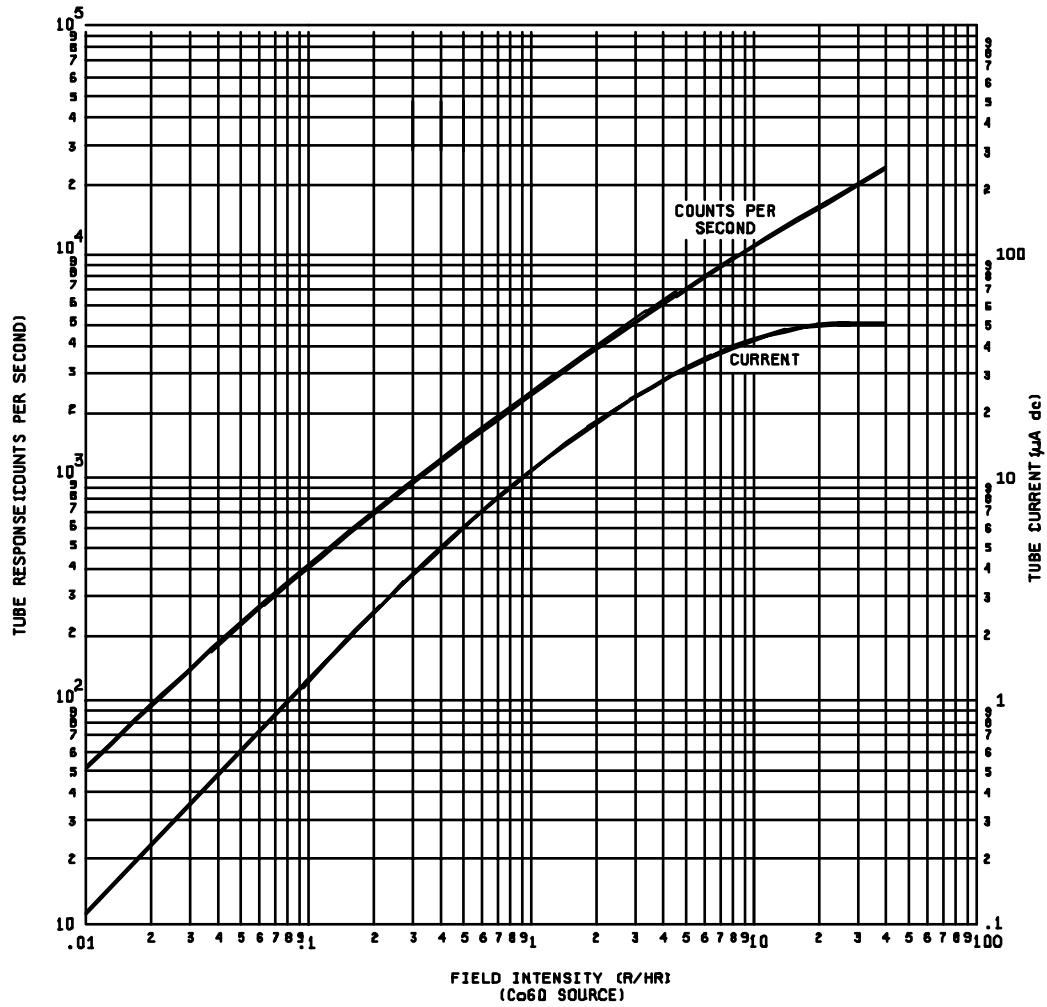


FIGURE 3. Response characteristics of electron tube type 7301.

NOTES

Referenced documents. In addition to MIL-PRF-1, this specification sheet references MIL-STD-1311.

Changes from previous issue. The margins of this specification sheet are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Navy - EC
DLA - CC

Preparing activity:

DLA - CC

Review activities:

Navy - AS, CG, MC, OS

(Project 5960-3709)

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